DOCUMENT RESUME

ED 302 843 CS 009 496

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TITLE Can Prior Knowledge Hurt Text Comprehension? An Answer Borrowed from Plato, Aristotle, and Descartes.
PUB DATE Nov 88
NOTE 14p.; Paper presented at the Annual Meeting of the National Reading Conference (38th, Tucson, AZ, November 29-December 3, 1988).
PUB TYPE Speeches/Conference Papers (150) -- Viewpoints (120)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Cognitive Structures; *Epistemology; *Prior Learning; *Reading Comprehension
IDENTIFIERS Aristotle; Descartes (Rene); Expository Text; Knowledge Acquisition; Plato of Athens; Propositional Analysis

ABSTRACT

Taking a philosophical approach based on what Plato, Aristotle, and Descartes said about knowledge, this paper addresses some of the murkiness in the conceptual space surrounding the issue of whether prior knowledge does or does not facilitate text comprehension. Specifically, the paper first develops a non-exhaustive typology of cases in which prior knowledge might not facilitate text comprehension. The paper then examines whether any of a subset of the cases, those in which prior knowledge hurts text comprehension, are really possibilities. The subset examined consists of 12 case-types in which the use of propositional knowledge in the comprehension process hurts propositional outcomes. (MS)

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Running head: Knowledge and comprehension

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Can Prior Knowledge Hurt Text Comprehension?

An Answer Borrowed from Plato, Aristotle, and Descartes

Over the past decade or so reading researchers have paid increasing attention to prior knowledge and its role in reading. While the increased attention clearly has been fruitful, it also has revealed that prior knowledge is not the simple, precise concept we thought. Prior knowledge now seems to be a rather unmanageable concept because of a certain degree of vagueness at its core and fuzziness at its edges. In short, the conceptual space in which research on prior knowledge and its role in reading is conducted has become quite murky. For instance, it is no longer clear that prior knowledge always facilitates text comprehension. Some say it has been established that, in some cases, prior knowledge does not facilitate text comprehension. Others say that such states of affairs have at least a hint of the paradoxical about them.

This paper addressees some of the murkiness in the conceptual space surrounding this issue. Specifically, the paper first develops a non-exhaustive typology of cases in which prior knowledge might not facilitate text comprehension. It then examines whether any of a subset of the cases, those in which prior knowledge hurts text comprehension, are really possibilities. The approach taken is philosophical and is based on some of what Plato, Aristotle, and Descartes said about knowledge.

When Knowledge Might not Facilitate Comprehension

First, consider the following question. Does <u>prior</u> really add anything (except perhaps confusion) to the phrase <u>prior knowledge</u>? What is an example of knowledge which is not prior? Is there any of one's knowledge that one does not know yet? <u>Prior</u> does not accompany <u>knowledge</u> hereafter.

In a trivial sense, cases exist in which knowledge does not facilitate comprehension. In these cases, the knowledge that does not facilitate comprehension is not used in comprehension. For instance, I rarely, if ever, use my knowledge of driving when I am trying to comprehend an article in the Journal of Reading Behavior and that knowledge does not affect my comprehension of that article one way or another. Most of one's knowledge is similarly inert with respect to most of one's comprehension processes. Non-trivial cases are cases in which the use of knowledge in the comprehension process does not facilitate comprehension.

Such non-trivial cases could vary along at least four "dimensions". First, cases may vary in the type(s) of knowledge used. The orthogonal distinctions between propositional and procedural knowledge and between cognitive and metacognitive knowledge yield four types of knowledge, which on their own or in any of 11 combinations may not facilitate comprehension. Second, the use of knowledge might not facilitate comprehension in either of two ways but not both. Knowledge might either hurt comprehension or it is neutral with respect to comprehension. Third, it might be the process of comprehension, its outcomes, or both that is not facilitated. Fourth, the outcomes of the process might be either propositional or not. Thus, a typology of cases in which knowledge might not facilitate comprehension based on the four dimensions is a 15 x 2 x 3 x 2 matrix representing 180 types of cases.

The typology is not exhaustive. For instance, at least one more knowledge type, knowledge by acquaintance, exists. Also, since knowledge is an outcome of the comprehension process, case-types again can be generated from the distinctions between propositional and procedural

knowledge and between cognitive and metacognitive knowledge.

When the Use of Propositional Knowledge Hurts Comprehension Outcomes

This section considers whether a subset of the case-types really are possibilities. The subset consists of the 12 case-types in which the use of propositional knowledge in the comprehension process hurts propositional outcomes.

Propositional Knowledge and the Comprehension Process

The consideration of whether the case-types are possible requires at least a sketch of some of the roles propositional knowledge can play in the comprehension process. The sketch developed below is based on the following sketches of propositional knowledge, its dispositionality, and its structure.

Propositional knowledge in the Meno, Plato developed one of the first, if not the first, account of propositional knowledge as justified true belief. Specifically,

• x knows that p (where p is a proposition) if and only if

1. x believes that p. (e.g., I know that libraries have books in them.
2. p is true. Leslie knows that snow is frozen water.)
3. x is justified in believing that p.

Contrast this account with the following account of procedural knowledge based on Aristotle's distinction in the Nicomachean Ethics between theoretical knowledge and practical wisdom. Procedural knowledge may be delineated as

• x knows how to a (where a is an action) if and only if

1. x is able to a. (e.g., I know how to read.
2. a is voluntary. Leslie knows how to play the piano.)

3. x can repeatedly a.

Also in the Meno, Plato distinguished between knowledge and metacognitive knowledge. Given the above definitions of propositional and procedural knowledge, the difference between knowledge and metacognitive knowledge in both cases is solely a difference in the object known.

* x knows that p (where p is a proposition) and the knowledge is metacognitive if and only if

1. x believes that p. (e.g., I know that I am a careless reader.
2. p is true. Leslie knows that I like mysteries.)
3. x is justified in believing that p.
4. p refers to a mental subject or attributes a mental predicate to a subject.

The fourth clause must be a disjunction to capture both of the following examples:

- Leslie knows that reading takes time.
- Leslie knows that Chris likes to read mysteries.

* x knows how to a (where a is an action) and the knowing is metacognitive if and only if

1. x is able to a. (e.g., I know how to monitor my reading.
2. a is voluntary. Leslie knows how to tell if I am lying.)
3. x can repeatedly a.
4. a's object is mental.

The dispositionality of propositional knowledge In the Nicomachean Ethics, Aristotle argued that virtues, a subset of procedural knowledge, are dispositions. A disposition is specified by a set of causal if-then sentences. For instance, the brittleness of an object is specified by the

set of if-then sentences that indicate when the object would break if struck. Dispositional accounts of mental states became prominent again with behaviorism. Many of the arguments about mental states since then have been over the kinds of predicates to allow in the if-then sentences.

A dispositional account of propositional knowledge, justified true belief, specifies a set of causal if-then sentences entailed by the knower's believing that p. The sentences always include some which indicate when a belief can be acquired or lost. In other words, the set of if-then sentences always indicates some of the inferences one would make because one has a certain belief. For instance, x believes that p (where p is a proposition) entails

1. If x believes neither that q nor that not-q, and x comes to believe that p makes q probable, x acquires a tendency to acquire the belief that q.
2. If x believes with a strength of m_1 that q, x comes to believe with a strength of n that p makes q improbable, and $m < n$, then x acquires a tendency to lose the belief that q.

The structure of propositional knowledge The structure(s) of one's propositional knowledge may be treated as the set of relations which hold among the items of propositional knowledge. At present, reading researchers' accounts of the set usually are based on schema theory or one of its relatives. Other accounts are possible and some of them are compatible with schema theory and its relatives.

In the Meditations, Descartes' account of knowledge structure(s) is based on the support relations holding among items of propositional knowledge; that is, among justified true beliefs. Descartes pointed out that one's support (or justification in the psychological rather than the

normative sense) for a particular belief is often another belief. For instance, my belief that I will work for an hour is based on my beliefs that I will work until eight o'clock and that it is seven o'clock now. One structure of a set of beliefs is specified by the support relations that exist among the set's members. For instance, suppose Leslie believes three propositions: That p, that q, and that r. Some possible belief structures are:

- Linear, e.g., the belief that p supports the belief that q and the belief that q supports the belief that r.
- Branching, e.g., the belief that p supports both the beliefs that q and that r.
- Circular, e.g., the belief that p supports the belief that q, the belief that q supports the belief that r, and the belief that r supports the belief that p.
- Discontinuous, e.g., the belief that p supports the belief that q and neither belief supports the belief that r.

A support relation may be good or bad. A support relation is good if and only if

1) it is deductively valid or inductively strong.

2) the supporting belief(s) is true.

A true belief(s) can support a false belief when the support relation is inductively strong. When a support relation is good, the supported belief is justified. The set of good support relations among a set of true beliefs specifies a knowledge, rather than a belief, structure.

<u>The role of propositional knowledge in the comprehension process</u>

Propositional knowledge can figure in the comprehension process as an input

used in process and as a desired output of the process. Propositional knowledge is justified true belief. According to the sketch of a dispositional account of belief, a justified true belief is used in the comprehension process when the process makes true at least one of the if-then sentences entailed by the belief. Propositional knowledge as an outcome of the comprehension process is, according to the sketch of belief structures, a set of justified true beliefs structured by the good support relations among them. These two sets are not the only possible sets of propositional outcomes of the comprehension process. Two less but still desirable sets are the sets of unsupported true beliefs and of good support relations in which an unsupported true belief justifies another true belief. Finally, three undesirable sets can result--the sets of good support relations in which a false belief is supported, of false beliefs (supported and unsupported), and of bad support relations. The propositional output of a particular comprehension process is the union of the desirable and the undesirable sets.

The sketch of belief structures is the basis for a description of the kinds of effects that the use of propositional knowledge in the comprehension process can have on the proposition output of the process. The effect is the difference between the sets of beliefs and their support relations resulting from using the knowledge and the sets resulting from not using the knowledge. A belief set may differ from its counterpart, as can a support set from its counterpart, in either or both of the two ways:

- membership (e.g., the two sets of support relations intersect)
- number (e.g., one set of beliefs has more members than the other.)

The sketch of the dispositionality of belief provides a description of

when the use of propositional knowledge causes such differences. Such differences result if

1. The use of a justified true belief makes true one of the if-then sentences entailed by the belief indicating when a belief would be acquired or lost.
2. The sentence would not have been made true if the belief was not used.

Hence, acquiring a belief changes the membership and number of the support relations set as well as of the belief set. The belief gained comes with support relations to the beliefs from which it is inferred. Losing a belief alters the membership and number of the belief set and it almost always alters the membership and number of the support relations set. The number and membership is altered unless the lost belief neither supported, nor was supported by, any of the other beliefs in the set.

Thus, the use of propositional knowledge in the comprehension process affects the propositional output of that process if

1. One justified true belief(s) is used in the comprehension process.
2. The use makes an if-then sentence(s) entailed by the belief(s) indicating when a belief would be acquired or lost.
3. Making true the if-then sentence(s) results in propositional output that differs in membership or number from the output if the beliefs had not been used in the process.

This account only specifies sufficient conditions for the use of propositional knowledge in the comprehension process to affect propositional output. The use might bring about the acquisition or loss of beliefs in ways other than that specified in the second and third conditions. The set of conditions would be necessary and sufficient, but

would have less explanatory power, if the second and third conditions were replaced with

2' The use results in propositional output that differs in membership or number from the output if the beliefs had not been used in the process.

In either case, the effect is hurtful if and only if the propositional output from using the beliefs is worse than the output from not using the beliefs.

The appeal to "output quality" points up a substantial unclarity or problem in at least this account of when comprehension hurts propositional output. When the difference is no more than a difference in number across one of the desirable or undesirable sets, it is clear whether propositional output is hurt or not. For instance, if using the propositional knowledge brings about fewer justified true beliefs or more false beliefs than not using the knowledge, output is hurt. However, number differences across more than one of the desirable or undesirable sets can create difficulties. Suppose, use leads to more true beliefs, more false beliefs, and more bad support relations. Does truth carry the day? Membership differences, whether across one or more of the sets, compound the difficulty. For instance, suppose that the sets of justified true beliefs brought about by use and non-use are equal in number but different in membership. The judgement (if one is possible) of whether propositional output is hurt or not rests on a judgement of the worth of the two sets. Similar problems also arise for accounts of when comprehension facilitates propositional outputs. In short, what decision rules are used to judge whether propositional output has been hurt or facilitated in all but the simplest cases?

Are Any of the 12 Types of Cases Possible?

Seemingly, the simplest examples of the use of propositional knowledge hurting propositional outcome are those in which the difference between the use and non-use of the knowledge is a single belief. Seemingly, the simplest of such cases are of two kinds--the use causes either the acquisition of a false belief or the loss of a true belief. (When use causes the failure to acquire a true belief or to lose a false belief, a more complex account of the use is required.)

In the two kinds, the knowledge used consists of the sets of justified true beliefs and of good support relations. The relations are good because the true beliefs are justified. The use is inferential; it makes true an if-then sentence(s) indicating when a belief would be acquired or lost entailed by the knowledge.

Suppose the propositional output of the use of propositional knowledge during one a comprehension processes contains a false belief and its support relations. The relations in which the false belief supports a belief, by definition, are bad support relations. Relations in which other beliefs support the false belief, again by definition, are bad except those in a true belief(s) provides strong inductive support for the false belief. The false belief and relations would not be in the output if the knowledge had not been used. Propositional output is hurt by using the knowledge.

This state of affairs can obtain because propositional knowledge, or justified true beliefs and good support relations, can be used in comprehension to bring about a false belief and bad support relations. If the inference which yields a false belief is deductive, the inference is unsound. The inference either is invalid or, if valid, involves a false belief as well as a justified true belief(s). If the inference is induc-

tive, it may be inductively strong or weak and may or may not involve a false belief.

Thus, in the example, the use of knowledge during comprehension hurts propositional output. More precisely, when the false belief is acquired through an inductively strong inference that does not involve a false belief, the correct use of knowledge alone hurts propositional output. In other cases, it is the incorrect use of knowledge sometimes in conjunction with the use of at least one false belief that hurts propositional output.

A similar example shows that such uses of propositional knowledge can hurt propositional output by bringing about the loss of a true belief and its support relations. However, the output quality problem can arise. The lost support relations can be predominantly bad, yielding a better propositional output in this respect. Might not the loss of a substantial number of bad support relations outweigh the loss of one true belief and a few good support relations?

The examples of use causing the loss of a true belief and causing the acquisition of a false belief do not hinge on differences between cognitive and metacognitve propositional knowledge. Thus, similar simple examples can be constructed for when the knowledge used is either cognitive, metacognitive, or a combination of both. The output quality problem again breaks out once the propositional output includes both cognitive and metacognitive beliefs and their support relations. For instance, when is it better to gain cognitive knowledge at the expense of losing metacognitive knowledge?

In conclusion, there are at least 12 types of cases in which the use of propositional knowledge during comprehension can hurt propositional output.

Further, the use is likely to be incorrect and involve one or more false beliefs. However, it is often quite difficult to determine whether using propositional knowledge hurts the output or not. Hence, more conceptual murkiness exists in and surrounding the use of knowledge in the comprehension process than this investigation addressed.